

CLAIMS

What is claimed is:

- 5 1. A method for a printing device, the method comprising:
 - printing a test pattern on a print medium;
 - generating a digital image of the printed test pattern by an imaging device;
 - analyzing an interference pattern to measure for distortion of the print medium; and
- 10 2. The method of claim 1, wherein the calibration is performed while continuing to process a print job via the printing device, wherein the printing, generating, analyzing, and calibrating are performed repeatedly.
- 15 3. The method of claim 1, wherein the calibration is performed at a later time.
4. The method of claim 1, wherein the calibration is performed at a location different from the printing device.
5. The method of claim 1, wherein the interference pattern is a Moiré pattern.
6. The method of claim 1, wherein the printing device is from the group

consisting of a multi-component printer, a multi-component photocopier, a multi-component fax machine, a multi-component laser printer, a multi-component electrostatic printer and a multi-component ink-jet printer, wherein the test pattern is a reticle pattern, wherein the print medium is selected from the group consisting of paper, transparency, fabric, plastics, labels,
5 metal, cardboard, and container, wherein the container is selected from the group consisting of plastic, cardboard and metal, wherein the imaging device is selected from the group consisting of a scanner and a CCD camera.

7. The method of claim 1, wherein calibrating the printing device further comprises adjusting a timing of a firing of a printing station within the printing device
10 and/or adjusting algorithms to shift pixels during rasterization.

8. The method of claim 1, wherein simultaneously with the printing of the test pattern on the print medium, user data is printed on a same page of the print medium, and further comprising ejecting the print medium from the printing device, wherein the ejecting is performed in parallel to the analyzing and calibrating.

15 9. The method of claim 1, wherein the test pattern is predetermined, a periodicity of printing of the test pattern is predetermined, a position on the print medium for printing the test pattern is predetermined, the method further comprising:
prior to printing, generating, analyzing, and calibrating:
(i) storing the test pattern;
20 (ii) storing the periodicity of printing of the test pattern; and

(iii) storing the position on the print medium for printing the test pattern.

10. The method of claim 1, further comprising:

repeatedly calibrating the printing device while the printing device processes a print job, by:

- 5 (i) printing the next test pattern on the print medium;
- (ii) generating a next digital image of the test pattern by the imaging device;
- (iii) analyzing a next interference pattern corresponding to the next digital image; and
- (iv) based on the next interference pattern, calibrating the printing

10 device.

11. The method of claim 1, wherein analyzing the interference pattern further comprises:

isolating via edge detection the interference pattern from the digital image; comparing the interference pattern to the test pattern; based on the comparison, determining if a calibration of the printing

15 device needs to be performed.

12. The method of claim 1, wherein the printing device has a plurality of printing stations, wherein the test pattern is printed on the print medium by the plurality of printing stations, wherein the printing stations print with at least two components, wherein the components are from the group consisting of ink or toner, and wherein the

scanning device generates the digital image of the printed test pattern after the test pattern has been printed at all the printing stations.

13. The method of claim 12 wherein the two components comprise two of black, cyan, and magenta.

5 14. The method of claim 13, wherein analyzing the interference pattern is performed between printing stations before the printing stations have printed with all colors of the components.

15. The method of claim 1, wherein the printing device is an ink-jet printer, and the interference pattern is caused when a first spot printed by the ink-jet printer does 10 not bleed onto a second spot printed by the ink-jet printer.

16. The method of claim 1, wherein the printing device prints printed matter, wherein the printed matter is selected from the group consisting of a legal document, a currency, or a transferable voucher.

17. The method of claim 1, wherein the printing device comprises a duplex 15 printer, wherein automatic image alignment front to back is obtained by combining the front and back interference patterns and determining the amount of distortion in a process and/or scan direction.

18. The method of claim 1, wherein a color head of the printing device has a multiple head array, wherein test patterns cover a majority of a page of the print medium, wherein the imaging device is moveable, and wherein calibrating the printing device minimizes distortion by changing an alignment of at least one head in the multiple head array.

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19. A system for image distortion calibration, the system comprising:
a printing device;
an imaging device coupled to the printing device;
means for printing a test pattern on a print medium by the printing device;
means for generating a digital image of the printed test pattern by the imaging device;
means for analyzing an interference pattern to measure for distortion of the present medium; and means for calibrating the printing device, based on the measured distortion.

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15 20. The system of claim 19, wherein the means for calibrating calibrates the printing device while the printing device continues to process a print job, wherein the means for printing, the means for generating, the means for analyzing and the means for calibrating perform printing, generating, analyzing, and calibrating repeatedly.

21. The system of claim 19, wherein the printing device comprises a duplex

printer, wherein automatic image alignment front to back is obtained by combining the front and back interference patterns and determining the amount of distortion in a process and/or scan direction.

22. The system of claim 19, wherein the printing device is from the group
5 consisting of a multi-component printer, a photocopier, a multi-component fax machine, a multi-component laser printer, an multi-component electrostatic printer and an multi-component ink-jet printer, wherein the test pattern is a reticle pattern, wherein the print medium is selected from the group consisting of paper, transparency, fabric, plastics, labels, metal, cardboard, and container, wherein the container is selected from the group consisting
10 of plastic, cardboard and metal, wherein the imaging device is selected from the group consisting of a scanner and a CCD camera.

23. The system of claim 19, wherein the test pattern is predetermined, a periodicity of printing of the test pattern is predetermined, a position on the print medium for printing the test pattern is predetermined, the system further comprising:

15 (i) means for storing the test pattern;
(ii) means for storing the periodicity of printing of the test pattern; and
(iii) means for storing the position on the print medium for printing the
test pattern.

24. The system of claim 19, further comprising:
20 means for repeatedly calibrating the printing device while the printing device

processes a print job, by:

- (i) printing the next test pattern on the print medium;
- (ii) generating a next digital image of the test pattern by the imaging device;
- (iii) analyzing a next interference pattern corresponding to the next digital image; and
- (iv) based, on the next interference pattern, calibrating the printing device.

25. The system of claim 19, wherein the means for analyzing the interference
10 pattern further performs:

isolating via edge detection the interference pattern from the digital image; comparing the interference pattern to the test pattern; based on the comparison, determining if a calibration of the printing device needs to be performed.

15 26. The system of claim 19, wherein the printing device has a plurality of
printing stations, wherein the test pattern is printed on the print medium by the plurality
of printing stations, wherein the printing stations print with at least two components,
wherein the components are from the group consisting of ink or toner, and wherein the
scanning device generates the digital image of the printed test pattern after the test pattern
20 has been printed at all the printing stations.

27. The system of claim 26, wherein the at least two components comprise two of black, cyan, and magenta.

28. An article of manufacture including code for image distortion calibration of a printing device, wherein the code is capable of causing operations, the 5 operations comprising:

printing a test pattern on a print medium;

generating a digital image of the printed test pattern by an imaging device;

analyzing an interference pattern extracted from the digital image; and

based on the interference pattern, calibrating the printing device.

10 29. The article of manufacture of claim 28, wherein the calibration is performed while continuing to process a print job via the printing device, wherein the printing, generating, analyzing, and calibrating are performed repeatedly.

30. The article of manufacture of claim 28, wherein the interference pattern is a Moiré pattern.

15 31. The article of manufacture of claim 28, wherein the printing device is from the group consisting of a multi-component printer, a photocopier, a multi-component fax machine, a multi-component laser printer, an multi-component electrostatic printer and an multi-component ink-jet printer, wherein the test pattern is a reticle pattern, wherein the print medium is selected from the group consisting of paper, transparency, fabric, plastics, labels,

metal, cardboard, and container, wherein the container is selected from the group consisting of plastic, cardboard and metal, wherein the imaging device is selected from the group consisting of a scanner and a CCD camera.

32. The article of manufacture of claim 28, wherein simultaneously with the
5 printing of the test pattern on the print medium, user data is printed on a same page of the print medium, and further comprising ejecting the print medium from the printing device, wherein the ejecting is performed in parallel to the analyzing and calibrating.

33. The article of manufacture of claim 28, wherein the test pattern is predetermined, a periodicity of printing of the test pattern is predetermined, a position on
10 the print medium for printing the test pattern is predetermined, the article of manufacture further comprising:

15 prior to printing, generating, analyzing, and calibrating:
(i) storing the test pattern;
(ii) storing the periodicity of printing of the test pattern; and
(iii) storing the position on the print medium for printing the test pattern.

34. The article of manufacture of claim 28, further comprising:
repeatedly calibrating the printing device while the printing device processes a print
job, by:
(i) printing the next test pattern on the print medium;
20 (ii) generating a next digital image of the test pattern by the imaging device;

(iii) analyzing a next interference pattern corresponding to the next digital image; and

(iv) based on the next interference pattern, calibrating the printing device.

35. The article of manufacture of claim 28, wherein analyzing the interference
5 pattern further comprises:

isolating via edge detection the interference pattern from the digital image;
comparing the interference pattern to the test pattern;
based on the comparison, determining if a calibration of the printing device needs to
be performed.

10 36. The article of manufacture of claim 28, wherein the printing device has a
plurality of printing stations, wherein the test pattern is printed on the print medium by
the plurality of printing stations, wherein the printing stations print with at least two
components, wherein the components are from the group consisting of ink or toner, and
wherein the scanning device generates the digital image of the printed test pattern after the
15 test pattern has been printed at all the printing stations, and wherein analyzing the
interference pattern is performed between printing stations before the printing stations have
printed with all component colors.

37. The article of manufacture of claim 36, wherein the at least two components
comprise two of black, cyan and magenta.

38. The article of manufacture of claim 28, wherein the printing device is an ink-jet printer, and the interference pattern is caused when a first spot printed by the ink-jet printer does not bleed onto a second spot printed by the ink-jet printer.

39. The article of manufacture of claim 28, wherein a color head of the 5 printing device has a multiple head array, wherein test patterns cover a majority of a page of the print medium, wherein the imaging device is moveable, and wherein calibrating the printing device corrects an alignment of at least one head in the multiple head array.

40. The article of manufacture of claim 39, wherein the printing device comprises a duplex printer, wherein automatic image alignment front to back is obtained by combining the 10 front and back interference patterns and determining the amount of distortion in a process and/or scan direction.